

larger positive effect on higher educated women because of the higher opportunity cost. Thus, this factor's effect is ambiguous. Husband's income is also an important factor in childbirth as well as the wife's work. We may also consider that the conditions women experience vary between industries and occupations, and thus control its effect. Residence area should also be controlled because the labor market condition or availability of child-care facilities would vary widely by area. Making Tokyo the reference category, 46 area dummy variables are employed; however, results are not reported in this paper for brevity. Descriptive statistics are shown in Table 1.

Table 1 Descriptive statistics (N = 12,753)

	Mean	SD	Min	Max
Birth	0.1257	0.3315	0	1
After	0.4738	0.4993	0	1
Treat	0.3576	0.4793	0	1
After*Treat	0.1708	0.3763	0	1
Number of children aged 1–14	0.9292	0.9794	0	5
Wife's age				
20–25	0.0813	0.2733	0	1
26–30	0.3711	0.4831	0	1
31–35	0.5476	0.4978	0	1
Wife's education				
Junior high	0.0208	0.1427	0	1
High school	0.4288	0.4949	0	1
Junior/Tech. college	0.4186	0.4933	0	1
College/Graduate	0.1319	0.3384	0	1
Wife's experience in the firm (months)	97.98	47.21	21	240
Husband's income (in ten thousand yen)				
less than 250	0.2532	0.4349	0	1
250–299	0.2323	0.4223	0	1
300–399	0.1741	0.3792	0	1
400–599	0.2066	0.4049	0	1
600 or over	0.1338	0.3404	0	1
Wife's industry				
Mining	0.0006	0.0250	0	1
Construction	0.0499	0.2177	0	1
Manufacturing	0.2363	0.4248	0	1
Electricity, gas, heat supply, and water	0.0046	0.0679	0	1
Information and communication	0.0256	0.1581	0	1
Transport	0.0194	0.1381	0	1
Wholesale and retail trade	0.1440	0.3511	0	1
Finance and insurance	0.0556	0.2291	0	1
Real estate	0.0058	0.0760	0	1
Eating and drinking places and accommodations	0.0195	0.1384	0	1
Medical, health care, and welfare	0.3039	0.4599	0	1
Education and learning support	0.0183	0.1339	0	1
Compound services	0.0203	0.1411	0	1
Services, n.e.c.	0.0961	0.2948	0	1
Wife's occupation				
Professional and technical workers	0.2548	0.4357	0	1
Clerical and related	0.4230	0.4941	0	1

Sales	0.0770	0.2666	0	1
Service	0.1002	0.3003	0	1
Protective service	0.0002	0.0153	0	1
Transport and communication	0.0031	0.0559	0	1
Manufacturing and construction	0.1416	0.3487	0	1

Prefecture is not shown here.

5.2 Estimation results

Table 2 reports the estimation results, and the robustness of the policy effect by three models are tested. Model 1 includes only basic control variables. In this model, the coefficient of *After*Treat* shows a positive and significant effect, although it is at the 10% significance level. Model 2 adds wife's industry and occupation to Model 1. Some industry categories exhibit a statistically significant effect, and the sign and significance level of the coefficient of *After*Treat* does not change. Model 3 includes residency prefecture, and the coefficient of the *After*Treat* remains significantly positive in the full model. Therefore, the Act has a positive effect on the probability of childbirth.

We find a positive effect of the Act on childbirth, but its significance level is not very high. There seem to be three reasons for this result. First, sufficient time has not passed since the Act's implementation. Large firms actually began to support their employees' child bearing and rearing after the policy was implemented. However, it is reasonable to assume that the policy's influence on household behavior requires a rather longer time. The second reason is that the Act provides only an intangible incentive, a certification of good practice for compliant firms, but no punishment for non-compliant firms. This weak enforcement might undermine the policy. Third, Japan already has policies related to children and work retention, such as child allowance and paid maternity leave. The Act does not introduce a new system in this area, and thus its impact on the estimation equation for fertility might be weak. Nevertheless, our results demonstrate that the Act has had a positive effect on birth decisions, which indicates that the policy is effective in reversing the declining fertility.

Next, results of other variables in Model 3 are discussed. The number of children aged between 1 and 14 has a statistically significant, negative effect on childbirth. However, the effect of wife's age is not clear, possibly because the range of age in the sample is not very wide. Wife's education also has no significant effect because, as mentioned above, the effect is offset. However, wife's experience in the firm has a significant effect on fertility. This variable is used to capture the phenomenon that the longer women work in a firm, the more easily they balance work and child rearing. According to the estimate, after the peak at roughly 98 months of working at a firm, it is unlikely for women to give birth. Although the correlation between age and experience is not very high, the experience variable might reflect age as well. Husband's high annual income decreases the probability of childbirth because of the interaction between

the parents' demand for quality and quantity of children, as suggested by Becker (1960, 1981). Certain industries show a negative effect on childbirth compared to the medical, health care, and welfare industries. Occupation's effect on childbirth is also unclear.

Table 2 Estimation results

	Model 1	Model 2	Model 3
After	0.0191 (0.0370)	-0.0117 (0.0378)	-0.0100 (0.0381)
Treat	0.0361 (0.0416)	0.0509 (0.0444)	0.0621 (0.0449)
After*Treat	0.0831 (0.0597)	0.1075 * (0.0606)	0.1076 * (0.0610)
Number of children aged 1–14	-0.2571 *** (0.0177)	-0.2603 *** (0.0184)	-0.2708 *** (0.0187)
Wife's age (Ref: 31–35)			
20–25	0.1301 ** (0.0523)	0.0985 * (0.0593)	0.0926 (0.0598)
26–30	0.1000 *** (0.0318)	0.0252 (0.0356)	0.0208 (0.0358)
Wife's education (Ref: High)			
Junior high		-0.1649 (0.1263)	-0.1633 (0.1271)
Junior/Tech. college		0.0567 (0.0357)	0.0595 (0.0363)
College/Graduate		0.0549 (0.0506)	0.0638 (0.0516)
Wife's experience		0.0067 *** (0.0015)	0.0067 *** (0.0015)
Wife's experience squared/10		-0.0003 *** (0.0001)	-0.0003 *** (0.0001)
Wife's industry (Ref. Medical etc.)			
Mining		0.2687 (0.5792)	0.3771 (0.5869)
Construction		-0.2301 *** (0.0849)	-0.2184 ** (0.0857)
Manufacturing		-0.1903 *** (0.0612)	-0.1718 *** (0.0619)
Electricity, gas, heat supply, and water		-0.1340 (0.2205)	-0.0866 (0.2231)
Information and communication		-0.3669 *** (0.1028)	-0.3540 *** (0.1042)
Transport		-0.1606 (0.1181)	-0.1415 (0.1196)
Wholesale and retail trade		-0.2360 *** (0.0617)	-0.2210 *** (0.0622)
Finance and insurance		-0.2224 *** (0.0823)	-0.2156 *** (0.0831)
Real estate		-0.2259 (0.2058)	-0.2136 (0.2080)
Eating and drinking places		-0.1966 * (0.0617)	-0.1771 (0.0617)

			(0.1183)		(0.1193)	
Education, learning support			0.0078		0.0326	
			(0.1036)		(0.1040)	
Compound services			0.0094		0.0098	
			(0.1079)		(0.1088)	
Services, n.e.c.			-0.2718	***	-0.2599	***
			(0.0620)		(0.0627)	
Wife's occupation (Ref: Clerical and related)						
Professional and technical workers			0.0434		0.0463	
			(0.0502)		(0.0506)	
Sales			0.0381		0.0374	
			(0.0639)		(0.0643)	
Service			0.0892		0.0990	
			(0.0597)		(0.0602)	
Protective service			0.6819		0.7225	
			(0.7792)		(0.7975)	
Transport and communication			-0.4218		-0.4189	
			(0.3536)		(0.3564)	
Manufacturing and construction			0.0299		0.0365	
			(0.0565)		(0.0570)	
Husband's income (Ref: less than 250)						
250-299			0.0796	*	0.0993	**
			(0.0410)		(0.0418)	
300-399			0.0544		0.0816	*
			(0.0456)		(0.0468)	
400-599			-0.0377		0.0022	
			(0.0457)		(0.0476)	
600 or over			-0.2966	***	-0.2762	***
			(0.0549)		(0.0555)	
Prefecture	No	No			Yes	
Constant	-1.0354	***	-1.1682	***	-1.2344	***
	(0.0349)		(0.0952)		(0.1281)	
Log likelihood	-4664.1		-4576.6		-4537.8	
Likelihood ratio	316.2	***	491.1	***	568.8	***
Pseudo R-squared	0.0328		0.0509		0.0590	
Number of sample	12753		12753		12753	

***:p<0.01, **:p<0.05, *:p<0.1

Robust standard errors are in parentheses.

5.3 Marginal effect of the Act

In this section, Act's marginal effect on fertility is discussed. However, we must be careful in interpreting the marginal effect of the interaction term. Ai and Norton (2003) note that we should be cautious in evaluating the marginal effect of the interaction term in a nonlinear model, such as a probit or logit model. The sign, magnitude, and significance of the interaction term depend on all the covariates in the model; thus, in certain cases, the marginal effects could have different signs and significance for different observations. Thus, we may confirm that the marginal effect of the Act using the result of Model 3.

Fig. 2 depicts the relationship between the predicted probability of childbirth, on the x-axis, and the marginal effect, on the y-axis. We find that there are no different signs in marginal

effects. The range of the marginal effect is from 0.02 to 4.21%⁵. The higher the predicted probability, the larger is the effect of the act. In other words, the policy is more effective, for example, for households with fewer children or with husbands having lower income.

Next, Fig. 3 illustrates the significance of the marginal effects of each sample. Two horizontal lines indicate the significance level: the upper line is the 5% level and the lower is the 10% level. That is, the sample above either line has a significant marginal effect. There are no samples above the 5% significance line, confirming that for each value, the marginal effects are significant in about 97% of the samples. As Fig. 3 also shows, above the 0.2 point of predicted childbirth probability, there are few insignificant samples. Thus, the Act does have an effect on the probability of childbirth.

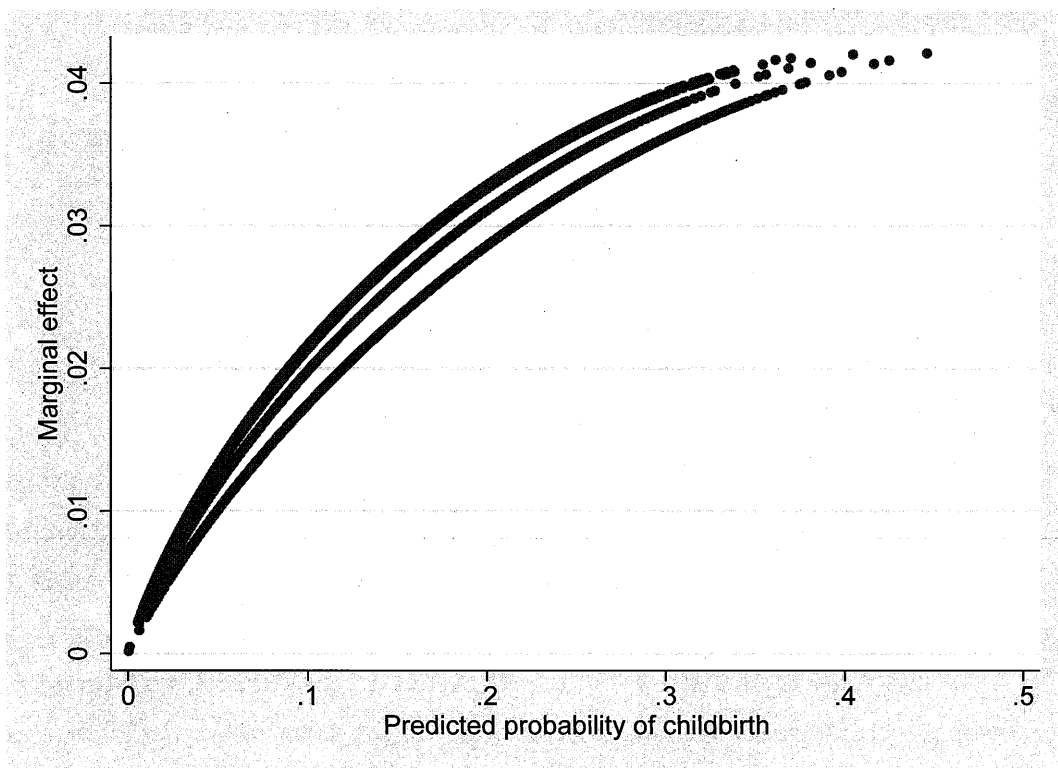


Fig. 2 Marginal effect of the Act

⁵ The marginal effect is calculated using the “inteff” command in Stata. For details of the command see Norton, Wang, and Ai (2004).

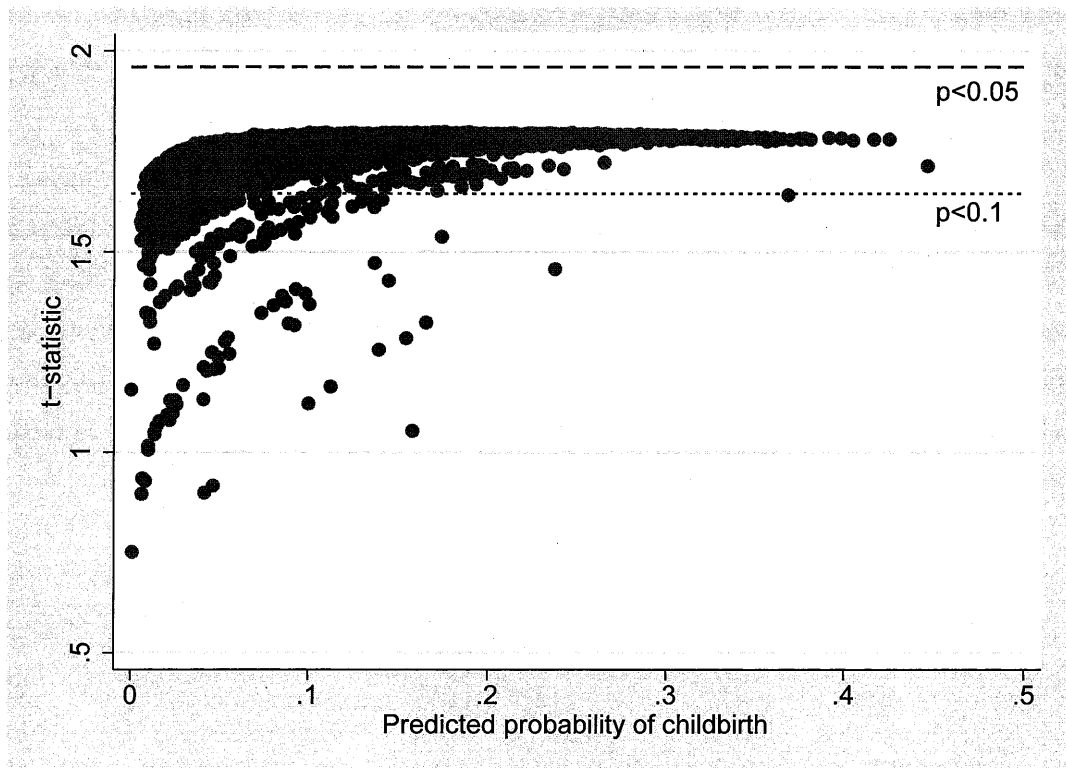


Fig. 3 Significance of marginal effect

6 Conclusion

The Japanese government has recently changed the policy direction for measures to reverse the birth rate's decline, now focusing on the role of firms. To tackle this problem, the *Act on Advancement of Measures to Support Raising Next-Generation Children* was enacted in 2005. The Act compels large firms to support their employees in bearing and rearing children.

Thus, this study investigates the effect of the Act on childbirth. Our DID estimation, using the quasi-experimental condition, demonstrates that the policy has a significant positive effect on the probability of childbirth. This indicates that the Act can reduce the cost of having children for working women. The marginal effect of the Act on the probability is roughly a maximum 4% increase.

This result also suggests that firms' role is crucial in improving Japan's birth rate. The Japanese government, till date, attempts to increase the availability of child-care facilities and introduce systems to support working women. However, even if there are sufficient facilities or systems, without firms' support it is difficult for women to use them, suggesting that this change in policy direction was successful.

An existing problem is that this study could not determine the effect of this particular measure on fertility. Future research should determine which measure is the most effective and calculate its magnitude.

Acknowledgement

The Employment Status Survey is provided by The Ministry of Internal Affairs and Communications. This research is supported by Health Labour Sciences Research Grant (The Ministry of Health, Labour and Welfare).

References

- Adserà A (2004) Changing fertility rates in developed countries. The impact of labor market institutions. *J Popul Econ* 17:17–43.
- Ai CR, Norton EC (2003) Interaction terms in logit and probit models. *Econ Lett* 80(1):123–129.
- Averett AL, Whittington LA (2001) Does maternity leave induce birth? *South Econ J* 68(2):403–417.
- Azmat G, González L (2010) Targeting fertility and female participation through the income tax. *Labor Econ* 17:487–502.
- Becker GS (1960) An economic analysis of fertility in *Demographic and Economic Change in Developed Countries*, Universities-National Bureau Conference Series 1. Princeton Univ. Press:209–240.
- Becker GS (1981) *A treatise on the family*. Harvard Univ. Press.
- Del Boca D (2002) The effect of child care and part time opportunities on participation and fertility decisions in Italy. *J Popul Econ* 15:549–573.
- Gupta ND, Smith N, Verner M (2008) The impact of Nordic countries' family friendly policies on employment, wages, and children. *Rev Econ Househ* 6:65–89
- Haah P, Wrohlich K (2011) Can child care policy encourage employment and fertility?: Evidence from a structural model. *Labor Econ* 18:498–512.
- Higuchi Y (1994) Ikuji Kyugyo Seido no Jissho Bunseki (An empirical analysis on the parental leave). In Shakai Hoshō Kenkyūjo (eds) *Gendai Kazoku to Shakai Hoshō: Kekkon, Shussho, Ikuji* (Contemporary Family and Social Security: Marriage, Childbirth, and Childcare) University of Tokyo Press, pp 181–204.
- Kalwij A (2010) The impact of family policy expenditure on fertility in western Europe. *Demogr* 47(2):503–519.
- McNown R, Ridao-Cano C (2004) The effect of child benefit policies on fertility and female labor force participation in Canada. *Rev Econ Househ* 2:237–254.

- Morita Y, Kaneko Y (1998) Ikuji Kyugyo Seido no Fukyu to Josei Koyosha no Kinzoku Nensu (The effect of the child care leave on women in the workforce). *Nihon Rodo Kenkyu Zasshi* 40(9):50–62.
- Norton EC, Wang H, Ai CR (2004) Computing interaction effects and standard errors in logit and probit models. *Stata J* 4(2):154–167.
- Schellekens J (2009) Family allowances and fertility: Socioeconomic differences. *Demogr* 46(3):451-468.
- Tanaka R, Kouno T (2009) Shussan Ikuji Ichijikin ha Shusshouritu wo Hikiageruka: Kenko Hoken Kumiai Panel Data wo Mochiita Jisshou Bunseki (Do childbirth allowances matter for fertility?: Evidence from the Japanese health insurance data) *Nihon Keizai Kenkyu* 61:94–108.
- Willis R (1973) A new approach to the economic theory of fertility behavior. *J Polit Econ* 81(2):S14–S64.
- Whittington LA, Alm J, Peters HE (1990) Fertility and the personal exemption: Implicit pronatalist policy in the United States. *Am Econ Rev* 80(3):545–556.
- Yoshida H , Mizuochi M (2005) Ikuji Shigen no Riyo Kanosei ga Shusshouryoku oyobi Josei no Shugyo ni Ataeru Eikyo (The effect of childcare resources on fertility and women’s labor supply) *Nihon Keizai Kenkyu* 51:76–95.
- Zhang J, Quan J, Van Meerbergen P (1994) The effect of tax-transfer policies on fertility in Canada, 1921–88. *J Hum Resour* 29(1):181–201.

別添 4

研究成果の刊行に関する一覧表

1. 書籍

なし

2. 論文

なし

